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Rana

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(54) **PRINT JOB TRACKING AND POLICY ENFORCEMENT**

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G06K 15/00 (2006.01)

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CPC ***G06F 3/1224*** (2013.01); ***G06F 3/1229*** (2013.01)

(58) **Field of Classification Search**
CPC ... G06F 3/1212; G06F 3/1218; G06F 3/1219; G06F 3/1239
See application file for complete search history.

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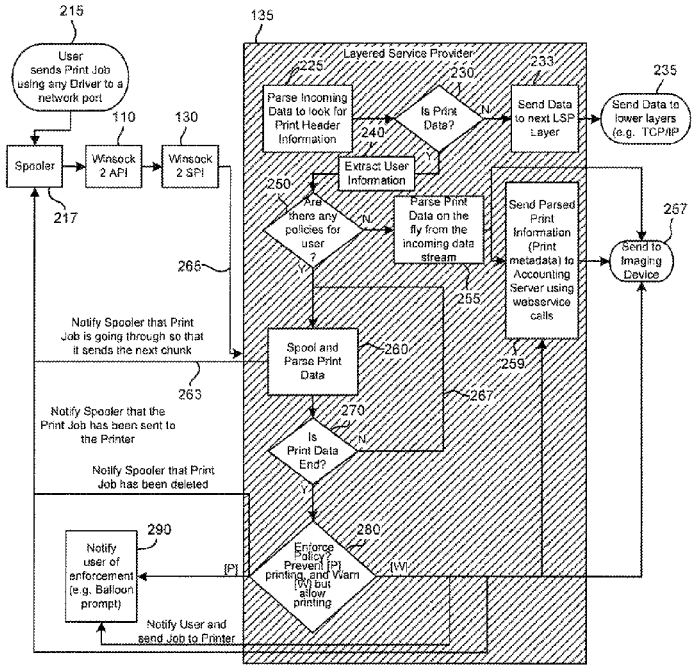
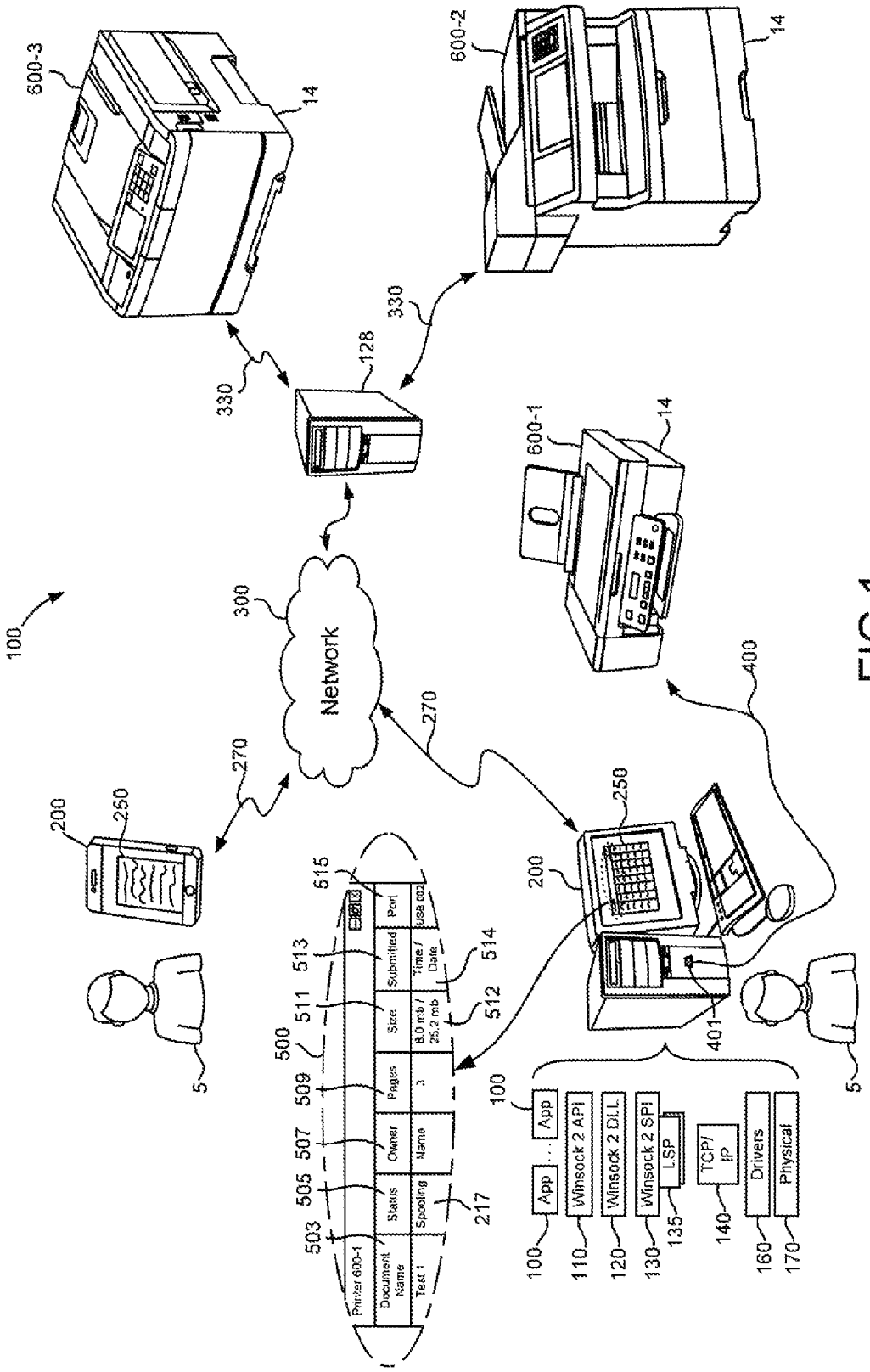
(57) **ABSTRACT**

Methods and apparatus enforce policy on print jobs and track them per users. A computing device has a layered service provider (LSP) and a spooler. The LSP determines whether data coming to it corresponds to print data or not. If so, it extracts user information and determines whether any imaging policies apply to the user. If policy applies, the LSP iteratively acknowledges to the spooler that data is being successfully transferred to an imaging device so the spooler will continue sending a remainder of the data corresponding to the print job. Upon receipt of an entire print job, the LSP enforces policy and notifies the user. It also notifies an accounting server to update its policies. Further embodiments note relationships between the LSP and spooler and their interaction with layers in a TCP/IP model.

12 Claims, 2 Drawing Sheets




600-3
14
600-2
14
330
330
128
600-1
14
100
300
Network
270
270
400
200
250
200
250
5
401
5
515
513
511
500
509
507
505
503
514
512
217
Printer 600-1
Document Name
Test 1
Status
Spooling
Owner
Name
Pages
3
Size
8.0 mb / 25.2 mb
Submitted
Time / Date
Port
USB 002
100
App
App
Winsock 2 API
Winsock 2 DLL
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LSP
TCP/ IP
Drivers
Physical
100
110
120
130
135
140
160
170

FIG.1

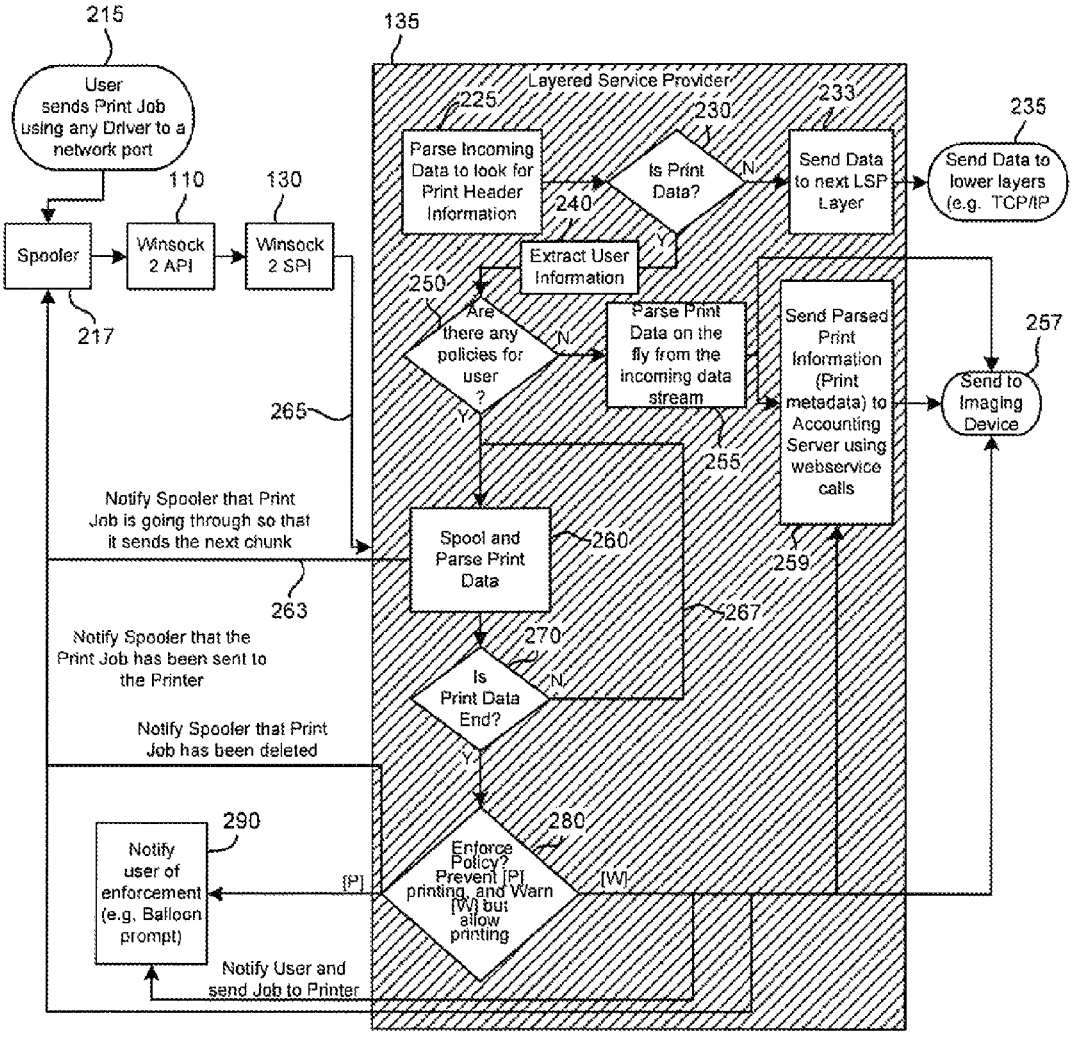
215
User sends Print Job using any Driver to a network port
135
Layered Service Provider
225
Parse Incoming Data to look for Print Header Information
230
Is Print Data?
Y
N
233
Send Data to next LSP Layer
235
Send Data to lower layers (e.g. TCP/IP
240
Extract User Information
110
Winsock 2 API
130
Winsock 2 SPI
Spooler
217
250
Are there any policies for user ?
N
Y
Parse Print Data on the fly from the incoming data stream
255
Send Parsed Print Information (Print metadata) to Accounting Server using webservice calls
257
Send to Imaging Device
259
265
Notify Spooler that Print Job is going through so that it sends the next chunk
263
Spool and Parse Print Data
260
267
Notify Spooler that the Print Job has been sent to the Printer
270
Is Print Data End?
N
Y
Notify Spooler that Print Job has been deleted
290
Notify user of enforcement (e.g. Balloon prompt)
280
Enforce Policy? Prevent [P] printing, and Warn [W] but allow printing
[P]
[W]
Notify User and send Job to Printer

FIG.2

PRINT JOB TRACKING AND POLICY ENFORCEMENT

FIELD OF THE INVENTION

The present invention relates to computing and imaging devices. More particularly, it relates to tracking print jobs of users and enforcing policies. Leveraging the functionality of a layered service provider typifies the embodiments.

BACKGROUND

In modern office environments, users send print jobs from computers, phones, tablets, etc. to print-release servers that hold them until users later pick them up at one of many networked imaging devices, e.g., printers, copiers, fax machines, etc. The servers not only hold print jobs until users authenticate themselves, but they track printing habits of users and enforce compliance of various policies of the office. The technique holds users accountable for their imaging projects including size, cost, quotas, etc. Users are only made aware of enforcement of policy however at a time when they interact with the user interface of the imaging device, not when they send their print job. Managed print services (MPS) is but one popular form of print release implementation.

In traditional office environments, users send print jobs direct to imaging devices by way of a network port of a computer, altogether bypassing print servers. For such users, it is difficult, if not impossible, for organizations to track their printing habits and enforce policies. Many organizations, however, would still like a mechanism to bring users of this type under their control. Similarly, smaller organizations without servers would also like a mechanism to bring about policy control, but without incurring the costs associated with relatively expensive print-release infrastructure.

Complicating the introduction of solutions is that not all imaging devices of an organization are of a same type. Many of them have dissimilar makes and models, each with their own proprietary, dissimilar printer drivers. In turn, introducing a comprehensive policy-enforcement solution in a fleet of such imaging devices is more complex than merely updating/patching existing printer drivers. It is insufficient to simply customize software code to implement common policies on dissimilar hardware devices with dissimilar software.

On the other hand, even if all the imaging devices were of a same make and model, updating/patching drivers becomes a tedious practice for IT departments. Not only must imaging policy be configured in software, the software must be installed on each and every driver per every computing device, or pushed to individual computers from a central location. The software must also contemplate nuances in drivers having differing existing patches and differing versions (older/younger) in comparison to other drivers. It is especially difficult to know these details when sometimes it is not possible to centrally know which computers have which driver versions installed thereon.

What is needed is a solution to enforce policy on users who print direct to imaging devices. The need extends to a generic solution in environments in which fleets of imaging devices are potentially dissimilar, including their printer drivers. Any solution should contemplate a contemporaneous notification to users if policy is being enforced against a current print job of their sending. Additional benefits and alternatives are also sought when devising solutions.

SUMMARY

The above-mentioned and other problems are solved by methods and apparatus that enforce policy on print jobs sent to an imaging device and track them per users. A computing device connected to the imaging has a layered service provider (LSP) and a spooler. The LSP determines whether data coming to it corresponds to print data or not. If so, it extracts user information regarding the print job and determines whether any imaging policies apply to the user, such as limits on numbers of printed pages, size, color, or the like. If policy applies, the LSP iteratively acknowledges to the spooler that data is being successfully transferred to the imaging device so the spooler will continue sending a remainder of the data corresponding to the print job. Upon receipt of an entirety of the print job, the LSP enforces policy and notifies the user. Typical enforcement includes stopping printing or allowing printing with a warning to the user. The LSP also notifies an accounting server to update its policies per the user and the enforcement against the recent print job.

In the event the LSP does not find a print job in data coming to it, the LSP passes the data direct to other LSPs, if any, and to lower layers in the internet protocol suite, commonly referenced as the TCP/IP model. In the event no policies require enforcement on the current print job, the LSP passes the print data direct to the imaging device for printing. It also notifies the accounting server with metadata to update its policies. Further embodiments note relationships between the LSP and spooler and their interaction with layers in the TCP/IP model.

These and other embodiments are set forth in the description below. Their advantages and features will become readily apparent to skilled artisans. The claims set forth particular limitations.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagrammatic view of a computing environment for print job tracking and policy enforcement; and

FIG. **2** is a flow chart of a representative embodiment for tracking and enforcement.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

In the following detailed description, reference is made to the accompanying drawings where like numerals represent like details. The embodiments are described in sufficient detail to enable those skilled in the art to practice the invention. It is to be understood that other embodiments may be utilized and that changes may be made without departing from the scope of the invention. The following detailed description, therefore, is not to be taken in a limiting sense and the scope of the invention is defined only by the appended claims and their equivalents. In accordance with the features of the invention, methods and apparatus teach policy enforcement on print jobs sent to an imaging device and track them per users.

With reference to FIG. **1**, a computing environment **100** includes computing devices **200** such as smart phones, laptops, desktops, tablets, etc. and imaging devices **600** such as printers, copiers, fax machines, etc. Users **5** interact with their devices **200** to engage items **250** such as documents, images, web pages, screen shots, messages, files, photos, etc. They request printing of the items by sending a "print job" direct **400** from a network port **401** to a connected imaging device **600-1** or indirect **270** by way of a print server **128** and attendant computing network **300**. As they print, a user interface messaging panel **500** is available to provide metrics about a current print job and any other print jobs in a queue, as is typical. These include, but are not limited to, the name of the document **503**, its status **505** spooling/printing, the owner of

the print job **507**, a number of pages **509**, a size of the print job **511** in both an amount of the print job being sent presently to the imaging device **512**/a total amount of the print job sent to the imaging device **514**, the time and date the job was submitted **513**, and through which port the job was sent **515**. The print job is generated by an application **100** of the computing device and formatted in a manner for controllers in the various devices to speak to one another in a same page description language, such as Printer Command Language (PCL), Postscript (PS), etc. In the network, the server forwards **330** the print job to a specific imaging device so users can claim a hard copy output at any of a variety of imaging devices **600-2**, **600-3** of their choosing. The network includes or not a variety of software to send and receive packets of information between devices and physical hardware to move the packets, such as routers, servers, switches, desktop/laptop computers, phone transmission towers, relay towers, satellites, fiber optics, phone lines, cables, etc. The connections are wired or wireless between a few or many such devices in an internet, intranet or other environment.

In a Transmission Control Protocol (TCP)/Internet Protocol (IP) reference model on the computing devices **200**, the applications **100** reside in an uppermost or highest layer. The applications are any of a variety but contemplate web browsers, word processors, email clients, games, etc. that users install on the operating system of the computer. Users interact with the applications by way of a display screen, pointing device, screen gesture, etc. and the applications communicate downward in the computer to lower layers of the TCP/IP model, as is known.

In sequence, the applications communicate downward with an Applications Programming Interface (API), especially Microsoft's Winsock 2 Application Programming Interface **110**, for example, along with Winsock 2 Dynamic Linked Libraries (DLL) **120**. This communicates downward to a lower layer, including a Winsock 2 Service Provider Interface (SPI) **130**. The SPI includes one or more Layered Service Providers (LSPs) **135**.

As LSPs are relatively modern, they are known generally as DLLs that use Winsock APIs to insert themselves into the protocol stack above lower transport and internet layers, such as TCP/IP **140**. The LSPs intercept and optionally modify inbound and outbound traffic between the internet/network **300** and applications **100**. Particularly, LSPs work by intercepting Winsock 2 commands before they are processed by ws2_32.dll and can therefore modify commands, drop commands, or log data which makes them useful for filtering and "sniffing" data. As will be seen below, however, the LSP(s) of the present disclosure are configured specially to intercept traffic between a spooler of the computing device and imaging devices **600**. They monitor traffic in a fashion similar to the way Winsock 2 monitors internet traffic, but here intercept data traffic between a network port **401** of the computing device and a connected imaging device, especially (but not necessarily) an imaging device **600-1** directly connected by way of a tether (cable) **400**. However, in situations when data coming to the LSP from upper layers does not constitute print or imaging data, the LSP is configured to merely act as a conduit in the protocol stack and lets advance data to the TCP/IP stack. Appreciating that many LSPs come pre-configured with operating systems installed on computing devices, such as Microsoft's Windows 7, further features of the invention include configuring existing LSPs to provide the foregoing and other services. Configuration can come by way of updates or patches sent to the computing device **200** over the network **300** or by way of computer readable media, not shown, such as disks or USB sticks that get inserted into the computers and install executable instructions. Configuration can also come by way of drivers **160** for the various imaging devices **600** that get installed and updated on the computing device. Beneath that, the physical layer **170** concerns itself with the transmission/reception of communications over the physical medium, as is typical.

With reference to FIG. **2**, users initiate a print job from their computing device. **215**. They send it to an imaging device through a network port. The print job is seen through any driver pointing to an IP port of an imaging device, thus making the technique here independent of any brand, make or model of printers. The print job is generally lengthy and typically spooled by a spooler **217** in the computing device so that the computing device can undertake other tasks while the print job gets printed. The spooler regularly communicates data of the print job to the imaging device in "chunks" or portions, often in sizes of about 4 MB at a time until an entire print job is sent. In order for the spooler to continue sending second, third or more chunks after sending a first, initial chunk, the spooler requires acknowledgement back that data is being sent successfully to the imaging device. In this regard, the LSP is used to acknowledge back to the spooler that data is indeed being sent successfully, as seen below.

Meanwhile, the LSP **135** intercepts all data traffic between applications and the internet/network, as well as data from the network port headed to imaging devices. As such, data received by the LSP is sniffed or parsed at **225** to determine whether it is data corresponding to a print job. The LSP receives the data through the overlapped Send API call and parses its job header to see if it corresponds to print header information. In Printer Job Languages (PJL), of which Postscript (PS) and Printer Command Language (PCL) language are common, print jobs include start makers in the form of: {Esc} %-12345X. In hexadecimal form, the start marker appears as: 0x1B, 0x25, 0x2D, 0x31, 0x32, 0x33, 0x34, 0x35, 0x58. Upon detection, the LSP concludes or not if data received at the LSP is print data of a print job, **230**. If the data is not print data, the LSP **135** simply delegates the call to the next LSP layer **233**, if any, and thence to lowers layers of the OSI model **235**, such as TCP/IP layers in the Transport and Network layers. Once there, the data is monitored inbound and outbound for other applications in the computing device, as is typical.

On the other hand, if the LSP concludes the data received at the LSP is indeed data of a print job at **230**, it next extracts user information from the data, **240**. In PS and PCL languages, the print job start marker is followed by information such as owner name (**507**, FIG. **1**) and document name (**503**, FIG. **1**). Once the name of user of the print job is known to an entity, policy limitations can be enforced on the print job, despite the print job having been sent through a network port direct to an imaging device. At **250**, the LSP determines whether the owner of the print job has any policies that need applying to the current print job. Policies can take any form an entity wishes to impose on the user and the following are representative, such as being able to only print a limited number of pages per print job, per month, etc., being allowed to print only in monochrome toner, not color, not being allowed to print at all, or the like. The LSP determines this by examining local cached policies or by making calls through the network (**300**, FIG. **1**) to a server (e.g., **128**) and conducting an LDAP lookup, for instance.

In either situation, if no policies exist that require applying to the current print job, the LSP parses the data coming to it on-the-fly without data again being spooled by the computing device. Rather, the data coming to the LSP for printing is not accumulated and sent the imaging device for rasterizing and

printing, **257**. The metadata of the print job is also sent to an accounting server (e.g., **120**, FIG. **1**) through a webservice call, for instance, so that policies can be updated per the user, **259**. As an example, if a user is only permitted to print 20 pages of color printing per month, and so far the user has printed 10 pages and the current print job consists of 10 pages of color printing, the user is permitted to print this time, but not a next color print job as the user will have reached their quota of 20 color pages per month. Thence, the current print job should be allowed to proceed, but not the next. The accounting server is updated to reflect this change in policy. The LSP will take notice of this during a next instance of a user sending a color print job and the LSP, again, inquiring about policies at **250**.

Alternatively, if policies do exist for the user at **250**, then an entirety of the data of the print job coming to LSP is spooled in the computing device before sending to the imaging device for printing, **260**. This is necessary since certain policies may or may not require enforcing until an entirety of metadata of a print job is known. For example, if a user is permitted to print 1000 pages per month, and has already printed 995, it is necessary to know whether the current print job has five or fewer pages, thence allowing printing to proceed, or whether it exceeds five pages, thence stopping printing entirely. It may be also possible to allow printing for the first five pages and thereafter truncating printing, but such has yet to be confirmed in practice.

As the data of the print job is being spooled, the spooler **217** expects some sort of feedback that data is actually being sent successfully to the imaging device. By setting the number of bytes in the LSP to what was actually received from the spooler, e.g., 4 MB "chunk," the spooler is spoofed into believing the print job is proceeding to the imaging device as is normal. This iteratively continues **263**, **265**, **260**, and **267** until there is no further data of the print job at **270** corning from the spooler **217**. As the last portion of data from the spooler may not correspond exactly to the "chunk" size earlier selected, e.g., 4 MB, the LSP notifies the spooler of receipt of the final or last chunk of data from the spooler by notifying the spooler of the exact size of the last chunk. This continues until there is no further data from the spooler, thus signaling the end of the print data. The LSP recognizes this in code as pages in print jobs have end page markers, as well as begin page markers. They are denoted in PCL-XL as: begin page marker 0xF8, 0x25, 0x43; and end page marker 0xF8, 0x31, 0x44. For other printing languages there are other unique byte sequences that are known.

At **280**, once the LSP has received the entirety of the print job, the policy per the user is enforced upon the current print job at **280**. To the extent the policy dictates that no printing can occur for the user, printing is prevented [P] and the user is notified at their computing device at **290** without the user needing to interface directly with the imaging device. The notice takes the form of a "balloon prompt" for instance, or other. The LSP also notifies the spooler **217** that the print job has been deleted. Conversely, the policy may not require any enforcement, but a preemptive notice or warning [W] can be sent to the user at **290**, but also having the print job proceed to printing at the imaging device, **257**. Metadata is also sent to one or more servers at **259** to update policies against the user.

Relative advantages of the many embodiments should now be apparent to those skilled in the art. By implementing a layered service provider that tracks print jobs and enforces policies, especially when users print jobs through a network port direct to an imaging device, specific advantages include but are not limited to:

I. For Users

1. Immediate notification of enforcement of policy at the computing device sending the print job instead of delayed notification when users seek to retrieve their print job and obtain messaging at the display panel of the imaging device; and
2. No visible impact during printing for those print jobs not having any applied imaging policies.

II. For System Administrators:

1. Policy enforcement occurs upon configuration of the LSP independent of any printer driver or print monitor change whereas prior art approaches having a language monitor or driver-based implementation included a step of configuration which needed to be run executed after every driver installation or maybe after every port change;
2. There are no customized solutions required for Windows 7 as may be required for a language monitor based solution; and
3. There are no customized solutions required of a printer driver or language monitor or requiring a print monitor or a virtual print monitor; and

III. For Solutions Provider:

1. Tracking of print jobs and enforcement of policy now occurs independent of types of imaging device and their proprietary print drivers and without any special installation or configuration; and
2. Tracking of print jobs and enforcement of policy now occurs in a fleet of diversified imaging devices, each with differing hardware and software, and still accounts for and enforces policy on all print jobs.

The foregoing illustrates various aspects of the invention. It is not intended to be exhaustive. Rather, it is chosen to provide the best illustration of the principles of the invention and its practical application to enable one of ordinary skill in the art to utilize the invention. All modifications and variations are contemplated within the scope of the invention as determined by the appended claims. Relatively apparent modifications include combining one or more features of various embodiments with features of other embodiments.

The invention claimed is:

1. A method for enforcing policy on print jobs sent to an imaging device from a computing device having a layered service provider configured with an operating system and a spooler, comprising:

determining whether data coming to the layered service provider in the computing device corresponds to a print job intended to be sent from the computing device to the imaging device; and

if so, and if imaging policies correspond to a user initiating the print job that require applying to the print job, repeatedly acknowledging from the layered service provider to the spooler within the computing device that the data is being successfully transferred to the imaging device but without actually sending any of the data in the print job to the imaging device thereby spoofing the spooler of the computing device so the spooler will continue processing a remainder of the data corresponding to the print job.

2. The method of claim **1**, further including directly sending the data from the computing device to the imaging device if it is determined that no imaging policies apply.

3. The method of claim **1**, further including determining an end of the data corresponding to the print job.

4. The method of claim **3**, waiting until the end of the data before applying any imaging policies to the print job.

5. The method of claim 4, further including notifying the user at the computing device of any enforcement of policy against the print job.

6. The method of claim 4, wherein the applying any imaging policies further includes preventing printing or allowing printing with a user warning.

7. The method of claim 1, further including delaying sending the print job to the imaging device from the computing device until an entirety of the print job has been sent to the layered service provider in the computing device.

8. The method of claim 1, further including accumulating metadata on the print job and updating the imaging policies for the user.

9. The method of claim 1, if data coming to the layered service provider does not correspond to the print job from the computing device to the imaging device, further including passing directly the data through the layered service provider to lower layers of a TCP/IP model.

10. A method for enforcing policy on print jobs sent to an imaging device from a computing device having a layered service provider configured with an operating system and a spooler, comprising:

identifying a start marker for a print job in data coming to the layered service provider;

extracting user information from the data;

determining whether any policies exist for a user sending the print job;

upon at least one policy existing for the user, spooling the data of the print job in portions until an end of the data is reached such that the layered service provider repeatedly acknowledges to the spooler within the computing device that the data is being successfully transferred to the imaging device but without actually sending any of the data in the print job to the imaging device until processing all of the data thereby spoofing the spooler of the computing device so the spooler will continue spooling the data in portions; and

waiting until the end of the data before applying any imaging policies to the print job.

11. The method of claim 10, if no policy exists for the user, passing the print job direct from the computing device to the imaging device.

12. The method of claim 10, if the layered service provider does not identify the start marker for the print job in the data coming to the layered service provider, further including passing directly the data through the layered service provider to lower layers of a TCP/IP model.

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